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Sampling and Analysis Plan for P-Q Interbed Sampling at Test Area North Operable Unit 1-07B

BECHTEL BWXT IDAHO, LLC

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ABSTRACT

This plan, together with the DOE/ID-10587 *Quality Assurance Project Plan for Waste Area Groups 1, 2, 3, 4, 5, 6, 7, 10, and Inactive Sites*, comprises the sampling and analysis plan for P-Q interbed sampling, and is no-longer contained-in determination sampling activities at Test Area North, Operable Unit 1-07B. Secondary containment and drill cutting sampling are also addressed in this plan. The format of the plan is based on Management Control Procedure-241, "Preparation of Characterization Plans."

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Appendix A—OU 1-07B P-Q Interbed Sampling and Analysis Plan Tables

FIGURES

TABLES

ACRONYMS

ASTU	Air Stripper Treatment Unit
bls	below land surface
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
COC	chain-of-custody
DAR	Document Action Request
DCE	dichloroethene
DOE	U.S. Department of Energy
DOE-ID	U.S. Department of Energy Idaho Operations Office
DQO	data quality objectives
EPA	United States Environmental Protection Agency
FY	fiscal year
ID	identification
INEEL	Idaho National Engineering and Environmental Laboratory
INTEC	Idaho Nuclear Technology and Engineering Center
MCP	management control procedure
NLCID	no-longer contained-in determination
OU	operable unit
PCE	tetrachloroethene
POD	plan-of-the-day
QA	quality assurance
QA/QC	quality assurance/quality control
QAPjP	quality assurance project plan
RCRA	Resource Conservation and Recovery Act

ROD	Record of Decision
SAP	Sampling and Analysis Plan
SMO	Sample Management Office
TAN	Test Area North
TCE	trichloroethene
TOC	total organic carbon
TSF	Technical Support Facility
VC	vinyl-chloride
VOC	volatile organic compounds
WAG	waste area group

Sampling and Analysis Plan for P-Q Interbed Sampling at Test Area North Operable Unit 1-07B

1. INTRODUCTION

This Sampling and Analysis Plan (SAP) describes the details for sample collection and analysis of core samples, no longer contained-in determination (NLCID) samples, secondary containment pad, and drill cutting samples to be collected from three new wells (Test Area North [TAN]-53, TAN-54, and TAN-55) to be drilled during the TAN Fiscal Year (FY)-00 well drilling campaign. Three additional wells, TAN-56, TAN-57, and TAN-58, will also be drilled as a part of the same drilling campaign. Because of their location, outside of the plume, the NLCID, containment pad, and drill cutting samples will not be necessary; however, core samples will be collected from TAN-56, and all three wells (56, 57, and 58) will have water samples collected and analyzed for volatile organic compounds. The well locations are shown on Figure 1-1. The SAP for this activity is comprised of this SAP together with the *Quality Assurance Project Plan for Waste Area Groups 1, 2, 3, 4, 5, 6, 7, 10, and Inactive Sites* (QAPjP) (DOE-ID 1997). Both of these plans have been prepared pursuant to the *National Oil and Hazardous Substances Contingency Plan* (U.S. Environmental Protection Agency [EPA] 1990) and SAP preparation guidelines from the EPA (EPA 540-R-93-071). The SAP describes the field activities and the analyses to be performed, while the QAPjP details the processes and programs that ensure generated data are suitable for their intended use. This plan is organized in accordance with Management Control Procedure (MCP)-241, "Preparation of Characterization Plans."

1.1 Sampling Approach

This SAP addresses the collection of two sample types—P-Q interbed sediments and NLCID water samples—that will be collected as a part of this sampling campaign. Interbed sediments will be collected to define the physical and chemical properties of the P-Q interbed. NLCID water samples will be collected to determine if groundwater containment is necessary during well drilling operations. Secondary containment pad and drill cutting samples will be collected to identify which materials are contaminated with Resource Conservation and Recovery Act (RCRA) F001-listed waste, and therefore, require treatment before disposal.

1.1.1 Interbed Sampling

Sediment cores will be collected from the P-Q interbed and analyzed for physical properties, volatile organic compounds (VOCs), and total organic carbon (TOC) content. Cores will be collected using a coring system with a retractable core tube (e.g., Longyear Punchcore,™ or Layne/Christensen Geobarrel™ system). This type of system will minimize disturbance of the interbed material, and maximize the opportunity for core recovery. The sediment will be collected in Lexan liners that will be removed from the core barrel following retrieval to the surface. Following visual inspection of the core, two 15-cm (6-in.) sediment intervals will be cut from the main body of the core for physical properties analysis. These samples will be capped and sealed inside the liners that will act as the containment devices during shipping. TOC and VOC samples will be collected from the core at each location where physical property samples are taken. Using a metal spatula, these samples will be removed from the Lexan liner and placed in glass vials for shipment to the lab. Although VOCs may be partially removed during the coring and sample collection process, the samples provide opportunity to distinguish variations in the VOC concentration vertically through the interbed.

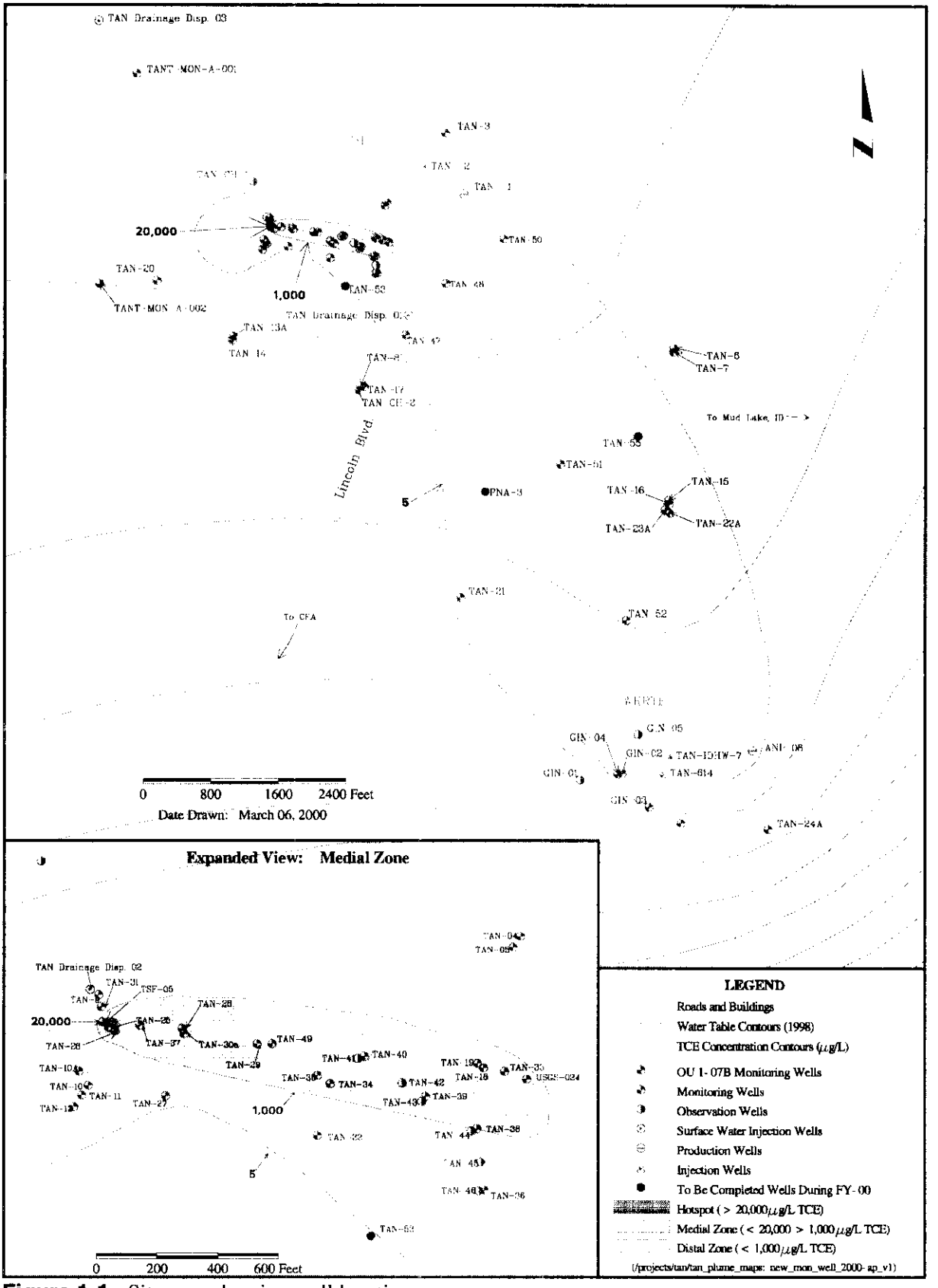

Figure 1-1. Site map showing well locations.

1.1.2 No Longer Contained-In Determination Sampling

NLCID groundwater samples will be collected and analyzed to determine the cumulative risk based on concentrations of trichloroethene (TCE), cis-and trans-1,2-dichloroethene (DCE), tetrachloroethene (PCE), and vinyl-chloride (VC). As water is encountered during the drilling process, a small volume of water will be removed from the borehole by blowing high-pressure air into the hole to lift the water to the surface where it will be containerized. Water samples will be collected from this volume of water for VOC analysis.

1.1.3 Secondary Containment Pad Sampling

If NLCID samples yield VOC cumulative concentrations greater than 1E-5, a secondary containment pad will be built beneath the drill rig to prevent groundwater from contacting the ground surface. When drilling is complete, the containment pad materials will be sampled to determine what material has been contaminated. Collection of the containment pad materials will be conducted according to the procedures outlined in the *Field Sampling Plan for Secondary Containment Pads for Test Area North Wells Operable Unit 1-07B* (Tomlinson 1998). In the event that containment pad construction and sampling becomes necessary, this SAP will be included in a document action request (DAR) to the *Field Sampling Plan for Secondary containment Pads for Test Area North Wells Operable Unit 1-07B* (INEEL/EXT-98-00569).

1.1.4 Supplemental VOC Sampling

Because wells TAN-56, TAN-57, and TAN-58 will be drilled beyond the limit of the 5μg/L TCE isopleth, water generated from these wells does not pose a health risk; consequently, collection of NLCID, and drill cutting samples will not be necessary, nor will construction of secondary containment pads. However, drilling water samples will be collected from these wells to improve project understanding of the groundwater beyond the 5μg/L isopleth. Two samples will be collected from each well, and shipped to the ALD laboratory at the Idaho Nuclear Technology and Engineering Center (INTEC) for analysis in accordance with SW846 Method 8260B. Sample collection, preservation procedures, container material, container size, and analytical methods will be identical to those identified in Sections 4.2 and 5.2.4, and Table 5-1, for NLCID samples.

1.2 Site Background

The Idaho National Engineering and Environmental Laboratory (INEEL) is a U.S. Government-owned facility managed by the Department of Energy (DOE). The TAN complex is located approximately 80 km (50 mi) northwest of Idaho Falls in the north central portion of the INEEL, and covers an area of about 30 km^2 (12 mi^2) (Figure 1-1).

From approximately 1953 to 1972, the injection well Technical Support Facility (TSF)-05 was used to dispose of liquid waste, generated by operations at TAN, into the underlying aquifer. In 1997 the groundwater beneath TAN was classified F001-listed waste. The contaminants of concern in groundwater at the site include the VOCs trichloroethene (TCE), cis-and trans-1,2-dichloroethene (DCE), tetrachloroethene (PCE), and vinyl-chloride (VC); and the radionuclides tritium, Sr-90, Cs-137, and U-234. Detailed descriptions of the historical background can be found in the remedial investigation report (Kaminski et al. 1994) and in the Record of Decision (ROD) (DOE-ID 1995).

The geology beneath TAN is characterized by basalt flows intercalated with sedimentary interbeds. Basalt flows are highly variable from dense to highly vesicular, and from massive to highly fractured. Sedimentary interbeds vary in thickness, but are generally thinner than interbeds found elsewhere on the INEEL. Two main interbeds, P-Q and Q-R, consist primarily of silt and clay. The P-Q interbed dips to the south such that the depth to the interbed varies from about 57.9 m (190 ft) below land surface (bls) near TSF-05, to about 103.6 m (340 ft) bls at well TAN-24a. The P-Q interbed is laterally extensive, but not continuous, and is only encountered in about half of the wells that are drilled to a depth where it would be expected. The P-Q interbed has an average thickness of about 1.8 m (6 ft) where encountered. Depth to the Q-R interbed ranges from about 137.2 to 143.2 m (450 to 470 ft) bls, with an average thickness of about 5.2 m (17 ft). The Q-R interbed appears to be laterally continuous in the area surrounding TAN and effectively confines contaminants within the aquifer. A more complete description of the geology, hydrogeology, and groundwater contamination at TAN is found in the TAN site conceptual model reports (Sorenson et al. 1996, Bukowski and Sorenson 1997, and Bukowski et al. 1998).

2. OBJECTIVES

The sampling objectives are discussed in the context of the data quality objectives (DQOs) process as defined by *Guidance for the Data Quality Objectives, EPA QA/G-4* (EPA 1994). This process was developed by the EPA to ensure that the type and quality of data used in decision making are appropriate for the intended application. The process includes several steps, each of which has specific outputs, that together form the DQOs for a given project. The DQO process has been used for this sampling activity in accordance with MCP-227, "Sampling and Analysis Process for Environmental Management Funded Activities". Each of the following subsections corresponds to a step in the DQO process and the output for each step is provided as appropriate.

2.1 Problem Statement

The first step in the DQO process is clearly to state the problem to be addressed in this sampling and analysis plan.

2.1.1 Inadequate Knowledge of P-Q Interbed Properties

The P-Q interbed is discontinuous in the area beneath the TAN facility; consequently, knowledge of the physical and chemical characteristics of the interbed is limited. Core samples are being collected to better define the physical and chemical characteristics of the interbed in an effort to improve understanding of contaminant migration and reactions at the interbed. Data generated from analyzing the core samples may be used to evaluate the numerical groundwater model.

2.1.2 Management of Produced Drilling Water

Because the groundwater within the identified plume beneath TAN is contaminated with RCRA F001-listed waste, NLCID samples must be collected from water generated during the drilling process to determine the presence and cumulative concentration of VOCs in drilling water reaching the surface. If VOC concentrations exceed a cumulative risk concentration of 1E-05, the water must be containerized at the drill site, and treated at the Air Stripper Treatment Unit (ASTU) at TAN prior to dispositioning; otherwise, it may be released back to the ground upon completion of well drilling activities.

In addition to the problem statement the other output for this step in the DQO process is an outline of personnel and assigned tasks associated with this sampling program. The personnel responsible for the sampling activities are presented in Table 2-1.

2.2 Decision Identification

The decision identification step in the DQO process is used to identify the decisions and the potential actions that will be affected by the data collected. The applications of this step are discussed below.

Table 2-1. Sampling tasks and responsibilities.

Functional Role	Responsible Organization	Person
TAN Operable Unit (OU) 1-07B Technical Manager	BBWI	L.N. Peterson
TAN OU 1-07B Remedial Design/Remedial Action Manager	BBWI	J. Rothermel
TAN OU 1-07B Project Manager	BBWI	A. Jantz
Technical Support	BBWI	J. Keck
Geologist	BBWI	W. Jolley
Engineering and Operations		
Project engineer interface	BBWI	J. Rothermel
Field operations supervisor	BBWI	M. Bartholomei

2.2.1 Core Sampling Decisions

The most important decision related to core sampling is to determine whether or not the data indicate that changes to the numerical model are necessary. Physical and chemical characteristics of the P-Q interbed will be acquired from the interbed samples, and will contribute to the overall data set defining the P-Q interbed. A sensitivity analysis of the numerical model may be required to determine the impact of the new data to the model.

2.2.2 NLCID Sampling Decisions

The decision related to NLCID sampling is to determine if water generated during the drilling process contains a hazardous waste. The VOC concentration will dictate whether the produced water must be treated before dispositioning, and if a secondary containment pad must be constructed. If the cumulative risk base concentration is greater than 1E-5, construction of a containment pad will be required, and water must be processed through the Air Stripper Treatment Unit (ASTU) prior to final dispositioning.

2.3 Decision Inputs

The following decision inputs are the parameters required to help make the decisions identified in Section 2.2.

2.3.1 Core Sampling Inputs

Decision inputs for the core samples are the parameters measured during sampling activities, which include analysis of select physical and chemical properties. Knowledge of the physical properties of the interbed are necessary to accurately model groundwater and contaminant migration through the interbed. The chemical properties of the interbed provide insight into how contaminants will react with the interbed. The analyte suite has been selected based on knowledge of past activity at the TSF-05 injection well, current understanding of the P-Q interbed properties, and prior knowledge of contaminant migration at TAN.

2.3.2 NLCID Inputs

The primary decision input for NLCID samples is the analysis of VOCs from groundwater derived while drilling. The cumulative VOC concentration will dictate the necessity for secondary containment at the drill site.

The analytes for each of these sample types are presented in Table 2-2. The precision and detection limits specified in the table represent the desired values, not necessarily the values that correspond to the method given. These values are chosen based on historical plume data and levels required to meet technical objectives. The proposed methods will meet the desired precision and detection limits.

2.4 Study Boundaries

This step in the DQO process defines the spatial and temporal boundaries of the study used to define the sample domain.

2.4.1 Temporal Boundaries

This drilling program is scheduled to begin in June, with sampling activities to begin in mid June, 2000. The wells will be drilled in sequential order, allowing approximately one month for completion of each well. Samples will be collected during each monthly period as presented in Table 2-2. Based on this schedule, drilling and all sampling activities are expected to be completed by the end of September; however, drilling and sampling activities will continue beyond September if necessary (until the project is complete).

Table 2-2. Sampling Schedule.

Well ID	Sample Type	Approx. collection date
TAN-53	NLCID	06/14/00
	Core	06/21/00
TAN-54	NLCID	07/14/00
	Core	07/21/00
TAN-55	NLCID	08/14/00
	Core	08/21/00
TAN-56	Supplemental VOC	09/14/00
		09/21/00
TAN-57	Supplemental VOC	10/21/00
TAN-58	Supplemental VOC	11/21/00

2.4.2 Spatial Boundaries

Core samples, and NLCID samples will be collected from wells TAN-53, TAN-54, TAN-55, and TAN-56 as discussed in Table 2-3. NLCID samples will be collected from near the surface of the watertable, and core samples will be collected from the P-Q interbed.

Table 2-3. Sample Depths.

Well ID	Sample Type	Sample Depth (ft bls)
TAN-53	NLCID	210
	Core	210
TAN-54	NLCID	210
	Core	255
TAN-55	NLCID	210
	Core	255
TAN-56	NLCID	210
	Core	370

2.5 Decision Rule

The objective of the decision rule step is to develop a logical statement that defines the conditions that would cause the decision-maker to choose among alternative actions. The decision rule is defined in the subsections below.

2.5.1 Core Sample Decisions

Core samples are being collected to provide additional information about the physical and chemical properties of the P-Q interbed that may be beneficial in evaluating contaminant migration. If analysis of the physical and chemical properties of the P-Q interbed yields values that are significantly different than those currently used in the numerical model, then a sensitivity analysis will be performed to determined if the model should be revised.

2.5.2 NLCID Decisions

The objective of collecting NLCID water samples is to determine if secondary containment, and water treatment procedures are necessary. Therefore, if analysis of the drill water yields a cumulative risk based concentrations greater than 1E-5, then secondary containment measures will be taken.

Table 2-4. Decision inputs for sampling.

Parameter	Significance	Proposed Analytical Method	Required Precision	Required Detection Limit	Potential Data Quality Problems
TOC	SW-846 Method 9060	9060	±25%	0.1 mg/L	Volatilization during holding time
VOC Target Analyte List = TCE, cis/trans-DCE, PCE, vinyl chloride	Determine the cumulative concentration of VOCs interbed core material	SW-846 Method 8260B	±25%	5 µg/L	Sample must be preserved to prevent degradation, and collected without headspace
Grain density	Measure of physical properties of the interbed for use in numerical modeling	ASTM D-854	NA	NA	Sample disturbance during collection and shipment
Hydraulic conductivity, permeability	Measure of physical properties of the interbed for use in numerical modeling	ASTM D-5856	NA	NA	Sample disturbance during collection and shipment
Grain size distribution	Measure of physical properties of the interbed	ASTM D-422	NA	NA	Samples must be disaggregated
Porosity	Measure physical properties of the interbed for use in numerical modeling	Methods of Soil Analysis PT 18.2	NA	NA	Sample disturbance during collection and shipment
VOC Target Analyte List = TCE, cis/trans-DCE, PCE vinyl chloride	Evaluate the cumulative concentration of VOCs to determine the necessity for secondary containment	SW-846 Method 8260B	±25%	≤2 µg/L	Sample must be preserved to prevent degradation, and collected without headspace

Table 2-2. (continued).

Parameter	Significance	Proposed Analytical Method	Required Precision	Required Detection Limit	Potential Data Quality Problems
VOC toxicity characterization leaching procedure	Identify contaminated drill cuttings and containment material	SW-846 1311/8260B	±25%	5 µg/L	Sample must be preserved to prevent degradation, and collected without headspace
VOC Target Analyte List = TCE, cis/trans-DCE, PCE Vinyl chloride	Information only.	SW-846 Method 82603	±25%	≤2µg/L	Sample must be preserved to prevent degradation, and collected without headspace.

2.6 Decision Error Limits

The purpose of decision error limits is to establish appropriate performance goals for data uncertainty.

2.6.1 Core Sample Error Limits

This step can be very detailed for site investigations where a statistical strategy is desired; however, decision error limits do not apply for P-Q sampling because the decision to be made is based on a qualitative assessment of the results.

2.6.2 NLCID Sample Error Limits

Collection of QC samples and laboratory verification that the required precision and accuracy for all analyses have been met, will ensure that any errors are within acceptable limits for NLCID samples.

2.7 Design Optimization

The purpose of design optimization in the DQO process is to identify the best sampling and analysis design that satisfies all of the previous steps in the process. This involves identifying the data that needs to be collected (analytes) as part of the sampling activities, including their purpose, the appropriate analytical methods, and the sampling locations and frequencies.

2.7.1 Coring Optimization

To provide core samples representative of the interbed material, the coring and sample collection process should produce minimal sample disturbance. Utilization of the Punchcore™ or Geobarrel™ coring system provides the best opportunity to collect undisturbed sediment samples from the P-Q interbed. However, depending on conditions encountered, it may be necessary to vary the parameters of the coring process (e.g., run length, air injection rate) to optimize core recovery.

2.7.2 NLCID Optimization

To obtain samples that accurately identify the cumulative VOC concentration of the produced drill water, water will be produced for approximately 10 minutes prior to collection to minimize turbidity in the water that may adversely affect sample analysis. Sample water will then be retrieved in a bucket and immediately transferred into an air-tight sample vial with no head space. Samples will be immediately taken to an onsite laboratory and analyzed within 24 hours to minimize volatilization during hold time at the lab.

3. SAMPLE LOCATION AND FREQUENCY

The material presented in this section is intended to support the DQOs summarized in Section 2. Samples will be collected as part of the TAN FY-00 well drilling program. Quality assurance (QA) samples will be included to satisfy the QA requirements for the data collection and analysis (see Section 7). Field guidance forms outlining sample collection location, sample numbers, and analyses requested will be provided for each sample location. The forms will be generated from the Integrated Environmental Data Management System database, which will ensure unique sample numbers. Sample and analysis tables for the groundwater analyses are provided in Appendix A of this plan.

3.1 Sampling Location

Samples will be collected from four new wells as outlined in Table 3-1. Figure 1-1 shows the location of all new wells to be drilled during the FY-00 drilling campaign.

Two core samples will be collected from the P-Q interbed, if encountered, in each new well. The interbed is expected to occur at an approximate depth of 64 m (210 ft) bls in TAN-53, and 82.3 m (255 ft) bls in TAN-54, TAN-55, and 112.7 m (370 ft) in TAN-56. One sample will be collected from near the upper boundary of the interbed, and a second sample will be collected from the interior of the interbed. Precise sample locations will be determined following visual inspection of the core at the time of collection.

Two NLCID samples will be collected immediately upon encountering the watertable in wells TAN-53, TAN-54, and TAN-55. The expected depth to the watertable is approximately 64 m (210 ft) bls in all wells. Laboratory samples will be collected from the discharge point on the cyclone separator.

Tow water samples for supplemental VOC analysis will be collected immediately upon encountering the watertable in wells TAN-56, TAN-57, and TAN-58. Samples will be collected from the discharge point on the cyclone seperator.

3.2 Sampling Frequency

Samples will be collected during the drilling/coring process, or upon completion of the drilling activities, depending on the sample type. All samples discussed in this SAP represent a one-time sampling event—no samples will be collected as part of an ongoing sampling program.

3.3 Presampling Meeting

A plan-of-the-day (POD) meeting will be conducted every day prior to the commencement of any drilling, coring, or sampling activities. The POD meeting will focus primarily on the drilling objectives, with emphasis given to sampling on days that samples will be collected. The POD will also cover task-specific health and safety, and waste management issues.

3.4 Sample Designation

A systematic character sample identification (ID) code will be used to uniquely identify all samples. The uniqueness of the number is required for maintaining consistency and ensuring no two samples are assigned the same ID code.

The first designator of the code, 1, refers to Waste Area Group (WAG) 1. The second and third designators will be "WD" indicating that the samples are being collected as part of the well drilling project. The next three numbers designate the sequential sample number for the project. A two character set (i.e., 01 = regular sample, 02 = duplicate) will be used next to designate replicate samples. The last two characters refer to a particular analysis. Refer to Section 4 for specific sample requirements.

For example, a NLCID sample collected from TAN might be designated as 1WD00101VA where (from left to right):

1	designates the WAG
WD	designates that the samples are being collected in support of the well drilling project
001	designates the sequential sample number
01	designates type of sample (i.e., regular sample)
VA	designates VOC analysis by SW 846 Method 8260.

A SAP table will be used to record all pertinent information (well designation, media, date, etc.) associated with each sample ID code. The SAP tables for all OU 1-07B P-Q interbed sampling activities are presented in Appendix A. Changes made to the plan while conducting field activities will be documented through the DAR process.

4. SAMPLING EQUIPMENT AND PROCEDURES

This section addresses the sampling equipment and procedures to be used during this sampling program. The following four major field activities, required to support the field evaluation, are explained in the rest of this section and are as follows: (1) interbed coring, (2) NLCID sampling, (3) radiological screening, and (4) sample transport and shipping.

4.1 P-Q Interbed Sampling

A continuous core of the P-Q interbed will be collected to provide interbed sediments from the entire thickness of the interbed. The objective of collecting core material is to refine our understanding of the physical characteristics of the interbed, and determine the vertical distribution of TOC, and VOCs within the interbed.

Core material from the P-Q interbed will be collected using either the Longyear Punchcore™, or the Layne/Christensen Geobarrel™ core system, supplied by the drilling subcontractor. The system that will be used will depend on the drilling company awarded the contract. Both systems are designed with the core tube attached to a spring within the core barrel, which allows the drive shoe and core tube to be pushed up the inside of the barrel upon contact with competent rock material. When fully extended, the drive shoe penetrates the sediment in advance of the core barrel bit, creating minimal core disturbance, and allowing for collection of a sample representative of the true hydrological and physical conditions of the interbed. The core will be returned to the surface with a wire-line retrieval system utilized by the core setup. Sediment will be collected in Lexan liners that will be capped and sealed upon removal from the borehole in accordance with the procedures discussed in SOP-11.12, "Soil Sampling."

4.1.1 Interbed Subsampling

Upon removal from the borehole, the core will be inspected to identify visible differences in the interbed sediments from which individual subsamples will be collected. Following visual inspection of the core, a hacksaw will be used to cut the lexan liner and core into individual samples. Care should be taken to prevent sediment disturbance while cutting the core. Two physical properties samples 15.2 cm (6 in) long will be collected, one from near the top of the core, and one from near the middle of the core. TOC and VOC samples will be collected from close proximity to the physical properties samples.

4.1.1.1 Physical Properties Subsamples. Core segments to be used for physical properties samples will remain in the lexan liner (not transferred to a separate container). The liner will be capped with a liner cap, such that the sediment is snug against the cap at both ends, and sealed with black electrical tape to form an air tight seal. Custody seals shall be placed over both caps to ensure no unauthorized tampering of the samples.

4.1.1.2 TOC Subsamples. Using a metal spoon, TOC samples will be transferred from the lexan liner to a 125 ml sample container. Sample containers shall be completely filled such that interbed material is snug against the cap. Metal spoons shall be washed with alconox, and double rinsed with deionized water between each sample.

4.1.1.3 VOC Subsamples. The process of coring poses a risk of driving off volatile compounds during core collection. Therefore, to minimize these risks, the flow rate of air injected while coring will be reduced to a minimum to maintain original borehole vapor conditions as nearly as possible and reduce volatilization. The coring process itself will utilize the Punchcore, or Geobarrel system to minimize disturbance of the interbed sediment. Subsamples will be collected from the main core body, capped and sealed as soon as possible following removal of the core from the borehole to minimize volatilization. In

addition, laboratory analysis will be conducted as soon as possible to minimize degradation during holding time.

Using a metal spoon, VOC samples will be transferred from the lexan liner to a 125 ml sample container. Sample containers shall be completely filled such that interbed material is snug against the cap. Metal spoons shall be washed with alconox, and double rinsed with deionized water between each sample.

4.2 Water Sampling

4.2.1 NLCID Samples.

NLCID water samples will be collected to determine the necessity for constructing a secondary containment pad around the well site. Compressed air from the drill rig will be used to lift water to the surface and through a cyclone separator. When the water arrives at the surface, a continuous stream of water will be passed through the cyclone for 10 minutes before water samples are collected. To collect samples, a small quantity of water (less than .1.9 L [0.5 gal]) exiting the cyclone will be caught in a 7.5 L (2 gal) or smaller bucket. Water from the bucket will be transferred directly to 40 ml glass VOA sample vials. Vials shall be filled such that the meniscus of the water rises above the top of the vial, and the cap shall be threaded tightly onto the vial, forcing out excess water, so that no head-space remains in the vial.

4.2.2 Supplemental VOC Samples.

Supplemental water samples will be collected to improve project knowledge of the groundwater beyond the extent of the 5µg?L isopleth. Compressed air from the drill rig will be used to lift water to the surface and through a cyclone separator. When the water arrives at the surface, a continuous stream of water will be passed through the cyclone for 10 minutes before water samples are collected. To collect samples, a small quantity of water (less than .1.9 L [0.5 gal]) exiting the cyclone will be caught in a 7.5 L (2 gal) or smaller bucket. Water from the bucket will be transferred directly to 40 ml glass VOA sample vials. Vials shall be filled such that the meniscus of the water rises above the top of the vial, and the cap shall be threaded tightly onto the vial, forcing out excess water, so that no head-space remains in the vial.

4.3 Radiological Screening

Based on previous project knowledge, it has been determined that sampling will occur outside of the area of radiological influence. Therefore, radiological screening of samples collected during this sampling program will be unnecessary.

4.4 Sample Transport and Shipping

Samples shipped to off-Site laboratories will be collected prepared, packaged, and shipped within 24 hours of sample collection. In all cases, the samples will be properly preserved and packaged (in accordance with Subsection 5.1).

4.5 Sample Equipment

Table 4-1 presents the equipment necessary or sample collection in the field.

Table 4-1. Sample equipment.

Equipment	Quantity	Use
Metal spoons	2	Sub-sampling the core
Hack saw	1 saw with 2 blades	Sub-sampling the core
2 gal bucket	1	Collection of NLCID sample
Alconox	500 ml	Decon of sampling equipment
De-ionized water	500 ml	Decon of sampling equipment
Kim wipes	1 pkg	Decon of sampling equipment
Spray bottle	2	Decon of sampling equipment
Electrical tape	4 rolls	Sealing the Lexan liner and cap

5. SAMPLE HANDLING AND ANALYSIS

5.1 Sample Handling

5.1.1 Sample Preservation

Samples collected for physical properties analyses will be capped and sealed in the field, no additional sample preservation is necessary. Samples collected from the core to be analyzed for VOCs will require a 14-day hold time, and cooling to 4°C. TOC samples from the core material will require cooling to 4°C, but should be analyzed as soon as possible. NLCID water samples will be analyzed as soon as possible after sample collection, and will require cooling to 4°C. Requirements for sample containers, preservation methods, sample volumes, and holding times are presented in Table 5-1.

5.1.2 Chain-of-Custody

To maintain and document possession of samples shipped to a laboratory for analysis, chain-of-custody (COC) procedures will be followed per INEEL MCP-244 "Chain-of-Custody, Sample Handling and Packaging" and the QAPjP. The purpose of the COC is to document the identity of the sample and its handling from the point of collection until laboratory analysis is complete. The COC record will be a multiple copy form that serves as a written record of sample handling. When a sample changes custody, the person(s) relinquishing and receiving the sample will sign a COC record. Each change of possession will be documented; thus establishing a written record tracking sample handling. The COC procedures will begin immediately after sample collection. The sample identification number, date, and time will be entered on the COC form the day of sample collection. Sample bottles will be stored in a controlled access area that is only accessible to the field team members.

Table 5-1. Sample container and preservation requirements.

	Container				
Analytical Parameter	Size	Type	Preservative	Method	Holding Time
Physical properties (interbed sediment) a) Hydraulic conductivity b) Porosity c) Grain density d) Grain size distribution	6-in. core section	Lexan core liner	None	a) ASTM D2434 b) Methods of Soil Analyses Ch. 18 c) ASTM D854 d) ASTM D422	NA
TOC (interbed sediment)	125ml.	AWM	4°C	SW 846 Method 9060	ASAP
VOC (interbed sediment)	125ml	CWM	4°C	SW 846 Method 8260B	14 days
Water	40 ml	Glass vial	4°C	SW 846 Method 8260B	14 days

5.1.3 Transportation of Samples

Samples will be transported in accordance with the regulations issued by the U.S. Department of Transportation (49 Code of Federal Regulations [CFR] Parts 171 through 178) and EPA sample handling, packaging, and shipping methods (40 CFR 261.C.3C.3). All samples will be packaged in accordance with the requirements set forth in INEEL MCP-244 "Chain-of-Custody, Sample Handling and Packaging" and the QAPjP.

5.2 Sample Analysis

5.2.1 P-Q Interbed Physical Properties

Physical properties to be analyzed include hydraulic conductivity, porosity, grain density, and grain size distribution. Hydraulic conductivity will be analyzed according to ASTM D2434. Porosity will be analyzed according to the protocol in Methods of Soil Analysis chapter 18. Grain density will be analyzed according to ASTM D854. Grain size distribution will be analyzed according to ASTM D422. The Sample Management Office (SMO) will contact the laboratory and make arrangements sample analyses.

5.2.2 Carbon Content

Interbed sediment samples will be sent to an off-Site laboratory for TOC analysis, using SW 846 Method 9060. The SMO will contact the laboratory and make arrangements for sample analyses.

5.2.3 P-Q Interbed VOCs

Interbed sediments will be analyzed for VOCs, specifically TCE, PCE, cis- and trans- 1,2 DCE, and VC. Laboratory analysis will be conducted in accordance with SW 846 Method 8260B. The SMO will contact the laboratory and make arrangements for sample analysis.

5.2.4 NLCID VOCs and Supplemental VOCs

Water samples will be analyzed for VOCs at the ALD laboratory at the Idaho Nuclear Technology and Engineering Center (INTEC) facility. Analysis will be performed according to SW 846 Method 8260B.

6. WASTE MANAGEMENT

Listed waste, as defined under the Resource Conservation Recover Act per 40 CFR 261 Subpart D, will be generated at OU 1-07B as a result of the sampling activities presented in this plan. The types, disposition, and handling of the listed waste that will be generated are discussed in this section and in the *Waste Management Plan for Test Area North Final Groundwater Remediation Operable Unit 1-07B* (INEEL 1999).

Potential waste streams to be generated as a result of this sampling campaign may include, drill water, drill cuttings, containment pad cuttings, PPE, and decon solutions, in addition to the Lexan liners, core material, water, and cuttings that may be produced while coring.

Water generated during the drilling process that is determined to have a VOC cumulative risk concentration greater than 1E-5 must be contained at the drill site and transported to the ASTU for treatment. The water will be processed through the air stripper located at TAN 29, and discharged to well TAN-49. The concentration of VOCs in all water treated by the air stripper will be reduced below the maximum contaminant level of 5 μg/L before reinjection.

Drill cuttings generated from wells yielding a VOC cumulative risk concentration greater than 1E-5 will be considered hazardous waste and will be handled according to the procedures discussed by Tomlinson (1998).

Waste generated during the coring activities will include all produced water or cuttings, in addition to any excess core (not sent to the lab for analysis) and Lexan liners. Coring water will be captured in a dedicated container and will be managed in the same manner as the drill water discussed above. All cuttings and excess core material will be placed in 207 L (55 gal) drums, wooden box 1.2 × 1.2 × 2.4 m (4 × 4× 8 ft), or other containers, appropriate for RCRA storage container that meet the requirements of 40 CFR 264, Subpart I. Filled drums or boxes will be temporarily stored in the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) storage area in accordance with MCP 3475, Temporary Storage of CERCLA Generated Waste at the INEEL, until waste generator services take possession of the materials.

Any waste streams generated from containment pad sampling will be managed in accordance with the procedures discussed by Tomlinson (1998).

7. QUALITY ASSURANCE

This plan is intended to be used in conjunction with the QAPjP and Section 13 of the *Implementing Project Management Plan for the Idaho National Engineering and Environmental Laboratory Remediation Program,* (INEEL 1997). The data quality indicators for all samples sent off-Site for analysis will be as specified in the QAPjP. Required precision for analytical methods were given in Table 2-2. Duplicates, field blanks, trip blanks, and rinsates will be used as specified in the QAPjP. NLCID sample data will dictate the sequence of events for drilling and sampling activities that follow.

The quality level determined for all sampling activities in this plan is quality Level 3 in accordance with the Project Management Plan and INEEL MCP-540, "Graded Approach & Quality Level Assignment." Even though most of the quality assurance/quality control (QA/QC) elements for definitive data will be used, the analytical data category required for this application is that of screening data *Guidance for the Data Quality Objectives, EPA QA/G-4* (EPA 1994) and the QAPjP. The data from off-Site analysis of the physical properties of the P-Q interbed will undergo Level A validation with Tier 1 data packages. The data from off-Site analysis of VOC samples from the interbed core will also undergo Level A validation with Tier 1 data packages. The data from offsite analyses of TOC samples will undergo Level C validation with a Tier 3 data package. Data from off-Site analysis of VOC samples containment pad material will undergo Level A validation with a Tier 1 data package. NLCID samples sent to a site laboratory will undergo Level X validation with Tier 3 data packages. Data from physical properties analyses will shall be returned in accordance with the data presentation format discussed in the appropriate ASTM method. The project team will review and validate the data from physical properties analyses.

8. REFERENCES

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Bukowski, J. M., H. Bullock, and E. R. Neher, 1998, *Site Conceptual Model: 1997 Activities, Data Analysis, and Interpretation for Test Area North Operable Unit 1-07B,* INEEL/EXT-98-00575, Revision 0.

DOE-ID, 1995, *Record of Decision: Declaration for the Technical Support Facility Injection Well (TSF-05) and Surrounding Groundwater Contamination (TSF-23) and Miscellaneous No Action Sites Final Remedial Action, Operable Unit 1-07B, Waste Area Group 1,* Idaho National Engineering Laboratory, Idaho Falls, Idaho.

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INEEL, 1999, *Waste Management Plan for Test Area North Final Groundwater Remediation Operable Unit 1-07B,* Idaho National Engineering and Environmental Laboratory, INEEL/EXT-98-00267, Revision 1.

INEEL, MCP-241, "Preparation of Characterization Plans," Idaho National Engineering and Environmental Laboratory, current issue.

INEEL, MCP-244, "Chain-of-Custody, Sample Handling and Packaging," Idaho National Engineering and Environmental Laboratory, current issue.

INEEL, MCP-227, "Sampling and Analysis Process for Environmental Management Funded Activities," Idaho National Engineering and Environmental Laboratory, current issue.

INEEL, MCP-3475, "Temporary Storage of CERCLA Generated Waste at the INEEL," Idaho National Engineering and Environmental Laboratory, current issue.

INEEL, SOP-11.12, "Soil Sampling," Idaho National Engineering and Environmental Laboratory, current issue.

Kaminski J. F., K. N. Keck, A. L. Schafer-Perinic, C. F. Hersley, R. P. Smith, G. J. Stormberg, and A. H. Wylie, 1994, *Remedial Investigation Final Report with Addenda for the Test Area North Groundwater Operable Unit 1-07B at the Idaho National Engineering Laboratory,* EGG-ER-10643.

Sorenson, K. S., A. H. Wylie, and T. R. Wood, 1996, *Test Area North Site Conceptual Model and Proposed Hydrogeologic Studies Operable Unit 1-07B,* INEEL/96-0105, Revision 0.

Tomlinson P. F., 1998, *Field Sampling Plan for Secondary Containment Pads for Test Area North Wells Operable Unit 1-07B*, INEEL/EXT-98-00569.

Appendix A

OU 1-07B P-Q Interbed Sampling and Analysis Plan Tables

Date: 06/22/00 Plan Table Revision: 3.0 Project: TAN FY-00 WELL DRILLING Project Manager: J. S. ROTHERMAL SMO Contact: D. M. FUNK

SAMPLE DESCRIPTION						SAMPLE LOCATION				ENTER ANALYSIS TYPES (AT) AND QUANTITY REQUESTED																			
SAMPLING ACTIVITY	SAMPLE TYPE	MEDIA	COLL TYPE	SAMPLING METHOD	PLANNED DATE	AREA	LOCATION	TYPE OF LOCATION	DEPTH (ft)	AT1	AT2	AT3	AT4	AT5	AT6	AT7	AT8	AT9	AT10	AT11	AT12	AT13	AT14	AT15	AT16	AT17	AT18	AT19	AT20
										PR	TT	VA	VE																
1WD001	REG/QC	WATER	DUP	GRAB	07/10/00	SECTION II	TAN 53	WELL	N/A			1	1																
1WD002	QC	WATER	TBLK	GRAB	07/10/00	SECTION II	QC - TAN 53	TRIP BLANK	N/A			1																	
1WD003	REG/QC	WATER	DUP	GRAB	07/20/00	SECTION III	TAN 54	WELL	N/A			1	1																
1WD004	QC	WATER	TBLK	GRAB	07/20/00	SECTION III	QC - TAN 54	TRIP BLANK	N/A			1																	
1WD005	REG/QC	WATER	DUP	GRAB	08/03/00	SECTION III	TAN 55	WELL	N/A			1	1																
1WD006	QC	WATER	TBLK	GRAB	08/03/00	SECTION III	QC - TAN 55	TRIP BLANK	N/A			1																	
1WD007	REG/QC	SOIL	DUP	CORE	07/12/00	SECTION II	TAN 53	CORE	N/A	1	2	2																	
1WD008	REG	SOIL	GRAB	CORE	07/12/00	SECTION II	TAN 53	CORE	N/A	1	1	1																	
1WD009	QC	WATER	RNST	GRAB	07/12/00	SECTION II	QC - TAN 53	RINSATE	N/A		1	1																	
1WD010	REG	SOIL	CORE	CORE	07/25/00	SECTION III	TAN 54	CORE	N/A	1	1	1																	
1WD011	REG/QC	SOIL	DUP	CORE	07/25/00	SECTION III	TAN 54	CORE	N/A	1	2	2																	
1WD012	REG/QC	WATER	RNST	GRAB	07/25/00	SECTION III	QC - TAN 54	RINSATE	N/A		1	1																	
1WD013	REG	SOIL	CORE	CORE	08/08/00	SECTION III	TAN 55	CORE	N/A	1	1	1																	
1WD014	REG/QC	SOIL	DUP	CORE	08/08/00	SECTION III	TAN 55	CORE	N/A	1	2	2																	
1WD015	QC	WATER	RNST	GRAB	08/08/00	SECTION III	QC - TAN 55	RINSATE	N/A		1	1																	

The sampling activity displayed on this table represents the first six characters of the sample identification number.
The complete sample identification number (10 characters) will appear on field guidance forms and sample labels.

AT1: Physical & Hydrologic Properties
AT2: Total Organic Carbon
AT3: VOCs (TCL)
AT4: VOCs (TCL) - MS/MSD
AT5:
AT6:
AT7:
AT8:
AT9:
AT10:
AT11:
AT12:
AT13:
AT14:
AT15:
AT16:
AT17:
AT18:
AT19:
AT20:

COMMENTS

PR = Hydraulic Conductivity, Porosity, Permeability to air, Grain density, grain size distribution.

VOC (TCL) = tetrachloroethene, trichloroethene, 1,1-dichloroethane, cis-1,2-dichloroethene, trans-1,2-dichloroethene, and vinyl chloride

Plan Table Number: WLCID WELL DEV.
SAP Number: IWEEL2000-00196
Date: 06/22/00 Plan Table Revision: 3.0

SAMPLING AND ANALYSIS PLAN TABLE FOR CHEMICAL AND RADIOLOGICAL ANALYSIS

Project: TAN FY-00 WELL DRILLING

Project Manager: J. S. ROTHERNAL SHD Contact: D. N. FUNK

SAMPLE DESCRIPTION						SAMPLE LOCATION				ENTER ANALYSIS TYPES (AT) AND QUANTITY REQUESTED																			
										AT1	AT2	AT3	AT4	AT5	AT6	AT7	AT8	AT9	AT10	AT11	AT12	AT13	AT14	AT15	AT16	AT17	AT18	AT19	AT20
SAMPLING ACTIVITY	SAMPLE TYPE	MEDIA	COLL TYPE	SAMPLING METHOD	PLANNED DATE	AREA	LOCATION	TYPE OF LOCATION	DEPTH (ft)	PR	TT	VA	VE																
1WD016	QC	WATER	FBLK	GRAB	07/10/00	SECTION III	QC - TAN 53	FIELD BLANK	N/A			1																	
1WD017	QC	WATER	FBLK	GRAB	07/20/00	SECTION III	QC - TAN 54	FIELD BLANK	N/A			1																	
1WD018	QC	WATER	FBLK	GRAB	08/03/00	SECTION III	QC - TAN 55	FIELD BLANK	N/A			1																	
1WD019	REG	SOIL	CORE	GRAB	08/22/00	SECTION III	TAN 56	CORE	N/A	1	1	1																	
1WD020	REG/QC	SOIL	DUP	GRAB	08/22/00	SECTION III	TAN 56	CORE	N/A	1	2	2																	
1WD021	REG/QC	WATER	DUP	GRAB	08/17/00	SECTION III	TAN 56	WELL	N/A			1	1																
1WD022	QC	WATER	RNST	GRAB	08/22/00	SECTION III	QC - TAN 56	RINSATE	N/A		1	1																	
1WD023	QC	WATER	TBLK	GRAB	08/17/00	SECTION III	QC - TAN 56	TRIP BLANK	N/A			1																	
1WD024	QC	WATER	FBLK	GRAB	08/17/00	SECTION III	QC - TAN 56	FIELD BLANK	N/A			1																	
1WD025	REG/QC	WATER	DUP	GRAB	08/31/00	SECTION III	TAN 57	WELL	N/A			1	1																
1WD026	QC	WATER	TBLK	GRAB	08/31/00	SECTION III	QC - TAN 57	TRIP BLANK	N/A			1																	
1WD027	QC	WATER	FBLK	GRAB	08/31/00	SECTION III	QC - TAN 57	FIELD BLANK	N/A			1																	
1WD028	REG/QC	WATER	DUP	GRAB	09/12/00	SECTION III	TAN 58	WELL	N/A			1	1																
1WD029	QC	WATER	FBLK	GRAB	09/12/00	SECTION III	QC - TAN 58	FIELD BLANK	N/A			1																	
1WD030	QC	WATER	TBLK	GRAB	09/12/00	SECTION III	QC - TAN 58	TRIP BLANK	N/A			1																	

The sampling activity displayed on this table represents the first six characters of the sample identification number.
The complete sample identification number (10 characters) will appear on field guidance forms and sample labels.

AT1: Physical & Hydrologic Properties
AT2: Total Organic Carbon
AT3: VOCs (TCL)
AT4: VOCs (TCL) - MS/MSD
AT5:
AT6:
AT7:
AT8:
AT9:
AT10:

AT11:
AT12:
AT13:
AT14:
AT15:
AT16:
AT17:
AT18:
AT19:
AT20:

COMMENTS

PR = Hydraulic Conductivity, Porosity, Permeability to air, Grain density, grain size distribution.

VOC (TCL) = tetrachloroethene, trichloroethene, 1,1-dichloroethene, cis-1,2-dichloroethene, trans-1,2-dichloroethene, and vinyl chloride